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COMMUNICATION

ON

WATER GAS

TO

ANDREW C. CRAIG, ESQ.,

PRESIDENT OF THE

PHILADELPHIA GAS WORKS,

BY

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PHILADELPHIA.

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DEAR SIR.—In compliance with your request for information on the subject of Water Gas for illuminating purposes, I am not aware that I can give you much of value, that you cannot find in most of our Works on Chemistry—on reference to them, you will learn that ever since water was discovered to be a compound of Oxygen and Hydrogen gases (which was during the last century), chemists have, by scientific manipulations, obtained Hydrogen gas from water and by the addition of Carbon formed Hydro-Carbon gas, which, when ignited, would produce both light and heat. Without going back to the early history of this method of forming Hydro-Carbon gas, I will only call your notice to the attempts that have been made within the last twenty-five years by different persons in Europe and our own country to introduce this gas into use for illuminating purposes.

In 1833, Mr. Jobard, a French chemist, made illuminating gas partly from the use of water. He obtained his Hydrogen from water by converting the water into steam and obtained Hydrogen from it by passing it through vertical retorts filled with incandescent coke, and united it just as it formed with Bi-carbureted Hydrogen produced in an adjoining retort, by the distillation in it of any Hydrocarburet, as oil, rosin, coal, tar, asphaltum, naphthaline, &c.

In 1848, Mr. S. White patented in England what he termed an improved apparatus for the manufacture of water gas. He used three retorts; in the first he generated steam; in the second Hydrogen, by passing the steam over and through highly heated charcoal or coke, mixed with thin scraps of iron; as it formed he passed it by a syphon into a third retort to mix with Bi-carbureted Hydrogen, formed in it by decomposing tar, rosin, bituminous coals, or other articles that would yield Bi-carbureted gas.

In 1849, Mr. J. P. Gillard, a French chemist, took out a patent for what he termed an improved method of generating both heat and light from Hydrogen gas obtained from water. His plan for obtaining Hydrogen was very similar to those of Mr. Jobard's and Mr. White's, but in place of uniting it with carbon to make it illuminating as they did, he caused a small jet of lighted Hydrogen to pass through a burner with very small holes in it on a thin strip of platinum wire, the threads being excessively fine. By this process the platinum threads were heated to such intense whiteness, that the luminous refulgence was extraordinarily brilliant. With some little modification of his method Mr. Kurtz, a large manufacturing chemist at Cornbrook, Hulme, (England,) lighted a part of his laboratory very successfully, as his works afforded him great facility to do so, without incurring much extra expense for apparatus.

In 1848, Mr. Payne, of the State of Massachusetts, made an attempt to introduce water gas into the City of New York for illuminating purposes, to be made by what he considered a new and improved method. He obtained his Hydrogen from water, by what chemists designate as the electro-magnetic process, and to make it illuminating he passed it through a vessel containing spirits of Turpentine to napthalize it,—or, (as I believe he stated at the time,) to simply catalyse it, viz., by passing it through spirits of Turpentine; according to his theory it would become illuminating without exhausting the Turpentine, except to a very limited degree.

In 1850, Mr. S. White, the English gentleman to whom I have already referred, introduced his method for making water gas into the City of New York, and I believe at the time lighted one of the hotels there with it, and, if I remember correctly, made some public exhibition with it.

In 1858, Mr. J. M. Sanders, of the State of Ohio, took out a patent for what he considers a new and valuable method for making water gas.

In the "*Scientific American*," a very valuable scientific paper, published weekly in New York, under date of October 29th last, I find the following observations relative to his plan, viz: "WATER GAS. On another page we have given the specification of Professor Sanders' patent for making water gas; also, a letter from him, and one from a correspondent on the subject. The views of the patentee and those of our correspondent do not seem to be based upon the invention as set forth in the patent. The process, as stated, consists in mixing water and coal-tar, or turpentine, &c., in a boiler. applying heat to it, and making the vapor so produced pass through the red hot charcoal in a retort. The gas thus obtained is that regarding which Professor Mapes has made such remarkable statements, according to our correspondent The subject of water gas is quite old, and Mr. White's method, patented January 29th, 1850, although somewhat different, appears to be superior to that of Sanders'. In the use of coal-tar with water, to produce gas, a very small portion of Hydro-Carbon vapor can pass over by Sanders' method, and turpentine is too expensive to use. The process, as described in the patent is almost impracticable for useful purposes, as the water and tar, or whatever may be used, should be first exposed in a retort in the method pursued by White. His plan consists in using two retorts; water was admitted to one in small quantities by a syphon, and falling upon red hot charcoal, and scraps of iron, it was decomposed, some passed off as carbonic oxyd (C. O.), a portion as hydrogen, and some as steam. These products were then passed by a pipe into the other retort containing rosin, and there united with the resinous gases, forming the hydro-carbon, or water gas. Gas obtained from the destructive distillation of rosin is a compound of olefiant and carbureted hydrogen $(C^2 H^2 + C H 2)$ and is highly luminous. Gas obtained from the vapor of water passing through red hot charcoal is a carbonic oxyd and hydrogen $(C O + H)$."

"According to Dr. Frankland, of Manchester, England, no portion of the hydrogen from water enters into chemical combination with carbon vapor in a retort. As neither carbonic oxyd nor hydrogen gas possesses illuminating power, of course we must consider that when these gases are mixed in any manner with illuminating gas, it is only for the purpose of dilution, not illumination. It is stated by Professor Sanders that he prefers to use coal-tar on account of its great cheapness; but if his invention is to supercede gas made from coal, as is contended by some, where can he get his coal-tar—this being the refuse of our coal gas works? The Philadelphia correspondent of the *New York Tribune*, in the issue of October 19th, 1859, gives a very unreliable account of this water gas, and the process by which it is made. He states, that the patent rights for eight states have been sold by Dr. Sanders for $80,000 and that good gas can be supplied for thirty to fifty cents per 1000 cubic feet. Such statements are calculated to deceive the people and do great injury. There is a great amount of ignorance prevailing regarding gas for illuminating purposes, many supposing that equal quantities of every gas are of equal value, which is far from being the case. Gas made from solid hydro-carbons, such as coal and rosin, is chiefly valuable according to the amount of olefiant gas which it contains. Rosin is superior to coal gas in quality, just because it contains far more olefiant gas; and cannel coal makes more olefiant gas than common bituminous coal."

Without adding any other names to those already referred to who have at different times attempted to introduce water gas for illuminating purposes, I will give you the opinions of a few learned scientific and practical chemists, both in Europe and our own country, as to its chemical properties and relative value compared with other materials and methods for generating gas light.

Dr. Musprat, a scientific chemist in England, and the author of a very valuable work on Chemistry, under the article on gas light, states as follows, viz: "When the vapor of water is passed over red hot coke and coal, and analysed, the resulting gas is found to consist in a hundred volumes of 56 of hydrogen, 29 carbonic oxide, 15.8 of carbonic acid, and of light carbureted hydrogen only two hundreds of one per cent. It contains no olefiant gas whatever—this experiment is quite conclusive against the use of water or steam. It is evident, that there are no products of the decomposition of water by red hot coal or coke that possesses any illuminating power. It has often been proposed to pass steam into the retorts during the distillation of coal, but such a procedure could have no good effect but the contrary. Water in its decomposition in the retorts furnishes oxygen to the carbon of the coal impovershing the gas, whilst the hydrogen of the water does not combine with the carbon of the coal, but is liberated."

In a Report made to the Smithsonian Institute in 1851 by Professor James C. Booth and Campbell Morfit on "Recent Improvements in the Chemical Arts," they state as follows, viz: "Hydrogen may be obtained from water by passing steam over incandescent iron or coal, or by magnetic force. Hydrogen burned by itself gives little or no light; in order to make it give a luminous light it must be napthalized, viz., passed through a liquid or over a solid hydro-carbon, (such as naptha or napthalin,) or mixed with the vapor of a hydro-carbon, in all which cases its illuminating property depends on the same causes as in all ordinary cases of combustion for light, viz., the inflammation of hydrogen and the precipitation and momentary incandescence of carbon in the flame."

In the "*Scientific American*" of Oct. 15th, 1859, published in New York, to which paper I have already referred, I find the following remarks in reference to some experiments made with water gas at Wilmington, Delaware: "The addition of the hydrogen of water to the heavy gas of rosin does not improve the quality; it merely dilutes it, and is like adding water to milk, to increase the quantity. An exhibition of this gas was given at the Fair of the American Institute in Castle Garden, New York, in 1849, and several towns in England were lighted with it a few years ago; but we understand they all gave it up after a brief trial."

In a valuable work published in Europe some years since and afterwards in this country under the title of "Information for the People," are the following remarks on gas light, viz: "It is a curious fact that the dilution of the heavier gases (obtained from bituminous coals, rosin, oil, and wax,) by hydrogen does not only deteriorate their quality by the actual amount of dilution, as in the familiar example of spirits and water, but to a much greater extent. This fact, important to gas makers, has been experimently proved by the author of the article "Gas Light," in the "*Encyclopedia Britannica.*"

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In this article it is stated: "In the first experiment we took a portion of coal gas, of the specific gravity .67, which we found consumed at the rate of 4400 cubic inches per hour, and yielded the light of eleven candles, being 400 cubic inches per hour for the light of one candle. This gas being diluted with a fourth part of its bulk of pure hydrogen acquired the specific gravity .55 and wasted away at the rate of 6545 cubic inches per hour, yielding the light of 10 candles. As a fifth part of the compound gas was hydrogen, the remaining four-fifths, amounting to 5236 cubic inches, was the quantity of the coal gas which in its diluted state gave the light of ten candles for an hour; so that 524 cubic inches of the original coal gas were requisite to give the light of one candle for the same time. But in its unmixed state 400 cubic inches were sufficient to give the light of one candle for an hour, and consequently the deterioration caused by the dilution was in the ratio of 524 to 400, or of 100 to 76, being 24 per cent."

While on the subject of water gas it may not be out of place to add some general remarks about illuminating gas. Every well informed scientific chemist knows, that by dry distillation or carbonization in a close vessel, all bodies of vegetable and animal origin disengage illuminating gas, and for the last fifty or sixty years the Professors of Chemistry in the colleges and scientific institutions in Europe and our own country have taught the students how to obtain hydrogen from water, and how to convert it into hydro-carbon gas for the purpose of giving light. All intelligent, skilful, illuminating gas manufacturers know that it is the *quality* and not the *quantity* of luminous gas that affords the most light, and of this fact they inform themselves by a careful photometrical measurement of its intensity, and they will always, if just to their customers, select the best articles for use, giving preference for them according to their relative quality and cost delivered at their works.

In England and France, after experiments made with water gas, oil gas, peat gas, rosin and asphaltum gas, &c., I believe all the large gas manufacturers there have adopted the rich bituminous coals as the best and cheapest article for their use, likewise that all the large gas manufacturers in the United States at present also use bituminous coals as preferable to other gas light producing articles, though at some factories they do, or might with advantage, use rosin or wood, as they produce excellent gas and in certain locations cost much less than coal.

In Germany, Dr. Pettenkoffer, a distinguished chemist at Munich, some years since introduced the use of wood for making gas light in place of bituminous coal, with great success, as his method produced superior gas and he found much better sale for the remaining charcoal and pyroligneous acid from the wood than he could for the coke and oil left from use of coal.

Dr. John C. Cresson, Engineer of Philadelphia Gas Works, has for several years past also used wood with advantage, especially when he could not get good gas making coals at fair prices. In former years when rosin was cheap, he used that article with great advantage, either by itself or in combination with coal.

In 1822, and several succeeding years, when I had the Gas Works situate in Lodge Alley, belonging to the Grand Lodge in our city, under my direction, I used exclusively either vegetable tar or rosin (as they were both cheap articles at that time, compared with bituminous coal) for all the gas required for that large hall and all its various apartments. I obtained a rich luminous gas from both articles; particularly the rosin, and so pure in quality as to yield a clear bright light without the expense of purifying. Some fourteen years since in traveling by steamboat down the Alabama and up the Mississippi river, I found some of the large steamboats on those rivers lighted with gas made from the refuse fat and grease saved on board the boats.

I fear I have made my communication longer than you might desire, however if it contains any information of value to you I shall be gratified. I know the deep interest that yourself and the Board of Trustees of the Philadelphia Gas Works feel in their continued prosperity and usefulness. If I have failed to give you all the information you desired on the subject of water gas, you can readily obtain what I may have omitted from either Dr. John C. Cresson, the Engineer of the works, or his son and assistant, Dr. Charles M. Cresson, as they are both theoretically and practically acquainted with all the various methods that have been discovered or introduced in the manufacturing of illuminating gas. My long association with them as one of the Trustees of the Works gave me a good opportunity to form some estimate of their superior qualifications for the offices they so ably fill.

With sentiments of respect I remain most respectfully,

Yours, &c.,

GEO. H. BURGIN.